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# STRATEGY RESEARCH PROJECT

## AEROMEDICAL EVACUATION, HOW WILL WE CLEAR THE NEXT BATTLEFIELD?

BY

COLONEL JOHN A. POWELL United States Army

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## AEROMEDICAL EVACUATION, HOW WILL WE CLEAR THE NEXT BATTLEFIELD?

by

Colonel John A. Powell U.S. Army

Colonel Wayne Foxworth Project Advisor

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U.S. Army War College CARLISLE BARRACKS, PENNSYLVANIA 17013

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## **ABSTRACT**

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The Army Medical Department (AMEDD) must conduct patient evacuation from the entire scope of the nation's battlefields. Clearing these battlefields requires more than mere transport of personnel with wounds or disease and non-battle injury. The continuum of care must be provided from initial identification of a casualty through transportation to a definitive hospital facility. The lack of comprehensive far-forward medical care, the speed of ground operations and decreased mobility of hospitals have created extended lines of medical evacuation that exceed today's capabilities. The current fleet of Army helicopters is unable to adequately evacuate along the extended distances between levels of care. With these factors in mind, the Army must obtain a long range, high-speed platform with onboard treatment capabilities. In summary, the AMEDD must transform our patient evacuation system to include new equipment with new doctrine, personnel and training.

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## AEROMEDICAL EVACUATION, HOW WILL WE CLEAR THE NEXT BATTLEFIELD?

The United States Army is currently undergoing a major effort to transform the way it fights, force capabilities, and much of the actual culture underlying the Army's methods to fight and win the nation's wars. A basic tenet of the fight is expected medical support rendered to soldiers when they become casualties on any battlefield. The battlefields of the present and future are becoming more extended and the weapon systems more lethal. It is the job of medical planners and caregivers to treat and return to useful service as many of the sick and wounded as possible, regardless of the outcome of transformation and how the future Army will look.

Many options exist for definitive care of the sick and injured soldier. Small numbers of casualties can receive life saving surgery far forward in the battle space and the necessity for onboard intensive medical care and further resuscitation and stabilization becomes part of the treatment plan. This type of onboard definitive care and monitoring has been available in the civilian sector for many years and continues to be upgraded. Americans have come to expect that same standard of care in the military realm, given a manageable number of casualties in the nation's most recent conflicts. The challenge for military medical planners is how to effect that level of care in any scenario, with any number of patients, over the ever-increasing transport distances required to move those patients. The increased oversight of each casualty mandates that "care in the air" will be capable and expected.

For many years the helicopter has been the mainstay of the Army's evacuation system. The transportation of a casualty from the point of injury or pickup without stabilizing his injuries is not an option. The increased evacuation distances, marginal range capabilities, lack of definitive onboard care and monitoring systems, as well as the aircraft's own survivability on the battlefield has made the role of the helicopter less certain.

Recent events have shown the future battlefield can not be defined in terms Americans have routinely used in the past. Solutions to the problems of how to safely move these casualties, and if necessary, care for them enroute will only come from a new mindset. This completed project will explore the nuances of casualty evacuation and suggest options for modifying existing platforms, combining assets and safely transporting patients in need of definitive medical care over any distances required for that care.

## **HISTORY**

The concept of a systematic approach to clearing casualties from the battlefield goes back to the Byzantine Empire when *Scribones* were paid a fee for each casualty they rescued.<sup>2</sup>

Until very recent times other armies treated only the casualties who could reach the surgeons under their own power or with the assistance of a comrade. Actually, there was a limited interest in evacuation. Most of the casualties that needed care beyond basic first aid had little chance of returning to active fighting. The ability to remove patients from the battlefields after the 18<sup>th</sup> century did not keep pace with the medical care and advances in that arena.<sup>3</sup>

Napoleon's Surgeon-Major of the Army, Dominique Larrey, noted that wounded died from want of assistance.<sup>4</sup> He changed the procedures for treating casualties, and mandated that casualties be collected at a spot where medical attention was gathered at the end of the battle. Larrey, in his later years, developed "Flying Ambulances" which transported patients to medical attention, instead of the reverse. These vehicles had some rudimentary enroute capabilities with trained personnel and dedicated assets. This organization was probably the first ever attempt at medical evacuation as opposed to simple patient transport.<sup>5</sup>

By the middle of the 19<sup>th</sup> century most military forces had developed some form of a patient evacuation system. As evidenced by the Crimean and American Civil Wars these systems were woefully inadequate. These failures led to a demand for better care for the wounded. Jonathan Letterman organized efforts in the United States to replace the existing medical evacuation structure. His model for clearing the battlefield, with the addition of upgraded assets, remains essentially unchanged today. Clara Barton, Florence Nightingale and the fabled Russian physician Nikolai Pirogov also made great strides in how patients were actually transported and provided care.<sup>6</sup> The increased emphasis on patient care, however, did very little to improve enroute medical care. This situation was based in large part on the choice of evacuation vehicles. Prior to WWI nearly every vehicle used by Armed Forces was also used for patient evacuation. Unfortunately, these vehicles had little or no onboard care capabilities.<sup>7</sup>

During and since the Second World War, there has been increased emphasis on using evacuation to actually benefit the patient during transport, rather than seeing it simply as another form of "cargo hauling". This requires specialized equipment and trained transport personnel. We see this development today primarily in some well-equipped ground vehicles and in some aircraft. In a large war, it is unlikely that any nation can afford to provide each casualty with modern intensive-care level care during transportation, and in such circumstances we will probably fall back on less-capable transport means. However, in peacekeeping or crisis response operations, in which fewer casualties are expected, our nations may demand that each and every patient receive the highest possible level of care.

In the present day the use of aircraft for transportation is considered routine. The transport of civilians on so-called "Life Flights" is nearly as routine, with the expectation that patients will receive any and all needed onboard care. It was not always so.

The history of aeromedical operations can be generally divided into four eras:

Period up to 1920 – Theory and heroic experiments

1920-1939 - Intermittent interest and development of systems

1940-1960 - Growth and development of systems

1961-present – Full acceptance, rapid growth, increased technology<sup>9</sup>

Although numerous reports have been made about the evacuation of patients from Paris in the 1870s by balloon, <sup>10</sup> no definitive data exists and the stories must be taken as such. <sup>11</sup> The first experimentation with aircraft to move patients was undertaken by the Surgeon General of the Dutch Army, General de Mooy. From 1895-1910 de Mooy developed an entire system for medical evacuation to include ground, rail, aircraft and sea borne means. In 1909 Dr. George Grossman and Lt. Albert Rhodes of the Coast Artillery Corps designed and built a bi-wing airplane specifically for transport of a patient. They attempted to sell the idea to the War Department and were met with decided skepticism. <sup>12</sup> The first recorded instance of actual evacuation of wounded casualties was in November 1915, during the retreat of the Serbian Army from Albania. Several marginally serviceable fighter airplanes evacuated casualties from the front lines, prompting the French Government to purchase airplanes for the specific use of evacuating casualties during WWI. At the end of WWI the U.S. routinely had patients transported from remote areas in the Curtis JN-4 "Jenny". The patient was placed in the fuselage and the confines of the aircraft dictated that inflight care was not a consideration. <sup>13</sup>

The next 25 years saw little progress in the transportation of patients. The Ford Tri-Motor of the U.S. Army was used in a few instances with an onboard physician and technician with access to drugs, some instruments, and splints and dressings. Isolated attempts were also made in sparsely populated areas of Sweden, Thailand, and Russia in floatplanes, amphibians and other civilian and military aircraft. The onboard medical care varied from none to minimal.<sup>14</sup>

In the 1940s WWII demanded the development of a worldwide evacuation policy for both Allied and Axis powers. The Germans had developed their system as a necessity to return patients up to 1600 miles during the Spanish Civil War and expanded it as air superiority allowed. Regardless of the availability of onboard care, the massive distances involved led to a heavy reliance on air evacuation in all theaters. The U.S. moved over 1 million patients utilizing cargo aircraft and transported all types of casualties. Many of these patients traveled the long distances of the Pacific Theater in various conditions. The transportation of these patients, many of whom were critically ill, demanded the development of some onboard care. Injections, transfusions, tracheal care and occasional pleural fluid and air aspirations were performed. Actual long-range aeromedical evacuation versus transport of patients finally became a reality.<sup>15</sup>

Regardless of the capabilities of onboard care during transport, it was paramount to effect movement of casualties from remote areas to definitive care in a timely fashion. The possible use of helicopters to effect rapid evacuation of casualties from the battlefield to hospitals was first demonstrated at the Medical Field Service School at Carlisle Barracks, Pennsylvania in 1935. 16 The first documented use of rotary wing transport in a combat situation was in April 1944. LT Carter Harmon used a helicopter to evacuate a stranded unit with casualties from a remote area near Mawlu, Burma. Harman had been trained to fly at the Sikorsky plant in Bridgeport, Connecticut and was flying one of the helicopters supplied by the Sikorsky at the request of the Army Surgeon General. Use of the helicopter for short-range transport became the mainstay of military medical services. 17 In the Korean War the first mass employment of rotary-wing aircraft for transport of battlefield casualties was undertaken with the Bell H-13 (OH). Late in 1950, the Army deployed four helicopter detachments, which were placed under the operational control of the Eighth Army Surgeon. Three of these detachments of four OH-13 helicopters actually transported casualties during the conflict. Those small units along with assistance from Marine and Air Force helicopters evacuated some 25,000 casualties. <sup>18</sup> In some cases DC-3s and other fixed wing aircraft moved casualties from far forward, hastily built landing strips. 19

The shortcomings of the early helicopters were magnified during their use in Korea and Indochina. Inability to perform onboard care, severely underpowered and short ranged rotary-winged aircraft led the Army to set up a competition which resulted in the Army selecting the Bell XH-40, later called the UH-1 "Huey", as the first dedicated aerial medical evacuation (MEDEVAC) platform. The use of the Huey in Vietnam was an unqualified success. The short distances of evacuation and the rapidity of transfer from injury to definitive hospital care meant there was a good chance a patient could be on the operating table within one hour. The first use of dedicated flying medics (FM), combined with increased transport speed meant the risk of dying if wounded was half of WWII. The rapidity of casualty transport to definitive medical care actually changed many accepted practices in the Operating Room. The horrific injuries that patients arrived with were previously unseen and new procedures had to be adapted for resuscitation. As in previous conflicts, inter-theater evacuation was often accomplished with cargo aircraft, although the inclusion of flight nurses and medical care onboard became a mainstay.

The last three decades have seen a significant increase in the onboard care delivered in the civilian sector of aeromedical evacuation. Nearly every piece of equipment found in the Emergency Department and Intensive Care Unit can be found in a variety of helicopters and

fixed wing evacuation platforms in "life flight" and fee for transport civilian evacuation systems.<sup>24</sup> The limited number of casualties in conflicts since Vietnam has not forced the military to add onboard care and monitoring systems in significant numbers to make an impact on a future battlefield with varied casualty types. The Army has developed upgrades to the Blackhawk, as the Huey is totally phased out of the active and reserve components of the Army by early 2004. The upgraded UH-60 Blackhawk is called the Q-model. This helicopter, which looks identical from the outside to the standard model, is equipped with new avionics and an onboard Oxygen Generating System (OBOGS) as well as quick access suction capabilities, and a slightly modified cabin to allow easier patient care inflight. The upgraded UH-60Q will however, not be available in sufficient numbers to make an impact until after 2006-2008.<sup>25</sup>

## **DOCTRINE**

Army Doctrine in FM-8-10-26 currently defines medical evacuation as:

The timely, efficient movement and en route care by medical personnel of the wounded, injured, or ill individuals from the battlefield and other locations to a medical treatment facility (MTF). The higher echelon of care is responsible for evacuation of patients from the lower echelon of care. Evacuation begins when medical personnel receive the injured or ill soldier and continues as far rearward as the patient's medical condition warrants, or the military situation requires.<sup>26</sup>

The U.S. Army further defines aeromedical evacuation as the use of an aircraft (fixed or rotary wing) that has the capability to provide enroute care. Use of aircraft for patient movement without the capability of providing en route care is termed casualty evacuation (CASEVAC). Three systems are recognized for MEDEVAC or CASEVAC. These systems are labeled dedicated, designated, and lift of opportunity.<sup>27</sup>

The dedicated system is one in which an aircraft is solely dedicated to the mission of aeromedical evacuation. The Air Ambulance (AA) companies primarily perform this role. A question often asked is why should a commander dedicate critical assets to non-warfighting duties? Several factors must be explored in order to understand the current significance of this basic imperative and why it must be preserved.

Preserving critical assets. Commanders consider the dead and wounded an impediment to the conduct and continuance of the battle. Historically, they are reluctant to divert critical combat assets in the heat of battle to care for the wounded.

Maintaining the will to fight. The will to fight and remain a cohesive unit in combat is predicated on defending your fellow soldier, on his defending you, and the knowledge that

someone will care for you if you are wounded. The more cohesive and trained the unit, the more there is a need to conserve that force with evacuation and care.

Returning trained assets to duty. As armies become skilled, the cost to replace a wounded soldier becomes more than the cost to treat and return to duty. Regardless of money, it takes TIME AND DIVERTED FIGHTING ASSETS to train replacements. Without evacuation and care, wounded and non-battle injuries can render units ineffective.

Availability of medically trained assets. The key to effective and timely evacuation is predicated on trained ambulance and medical personnel not being diverted to other tasks or located elsewhere.<sup>28</sup>

The designated system is one in which an aircraft is identified for use as either an aeromedical or CASEVAC transportation platform. The difference between the two platforms is whether en route care is aboard. During mass casualty (MASCAL) situations, other aviation assets (such as CH-47 units) may be designated for CASEVAC missions.<sup>29</sup>

The lift of opportunity is a system that utilizes empty aircraft during the backhaul after primary mission completion. Lift of opportunity is the least preferred system but must occasionally be used when other systems are overwhelmed or transport time is the most important consideration.<sup>30</sup>

The definition of the four levels (echelons) of care have been a relative constant during Army transformation:

Level I – Individual, combat lifesaver, combat medic, treatment squad and Battalion Aid Station (emergency care and routine sick call)

Level II - Clearing station, forward support medical care (resuscitative care)

Level III - Combat support hospitals with definitive surgical capabilities (definitive care)

Level IV - Level III plus recovery and rehabilitative care31

These levels of care are closely aligned with those outlined in the joint arena. Joint Pub 4-02 adds a 5<sup>th</sup> level of care with definitive rehabilitative, convalescent and restorative care available in most CONUS or CINC approved locations. Each of the succeeding levels of care possesses the same treatment capabilities of the preceding echelon and adds new treatment options.<sup>32</sup>

The dedicated addition of the forward surgical team to the Division medical care team has changed the positioning of the levels of care in the battlefield. The positioning of the Forward Surgical Teams (FSTs) as far forward as the Level I Battalion Aid Station has had a profound effect on the type of patient that must be evacuated. Patients that have had lifesaving surgery, but still need dedicated intensive care follow-up, will need to be evacuated across Level II

directly to Level III. The probable addition of Forward Surgical Teams as slice elements moved closer to the forward edge of the battle area increase the potential for this type of evacuation.<sup>33</sup>

The Army Medical Department is also frequently responsible for evacuation support to other services, joint and combined forces and civil and non-military governmental organizations (NGOs). Aeromedical evacuation units must be prepared to evacuate shore to ship for soldiers, sailors, airmen and marines as the Navy places hospital ships in the littoral as close as possible to the action.<sup>34</sup> Support with evacuation assets must also be provided to humanitarian operations, disaster relief, nation building and even the occasional drug interdiction operation.<sup>35</sup>

The current command and control of the basic assets of evacuation in a combat zone is normally a MEDEVAC Battalion. Individual units are most often assigned to a Medical Brigade and allocated one unit in support of a Division or equivalent, and one unit in General Support (GS) to the Corps per two divisions. Usually one unit per theater has the mission of evacuating patients to and from hospital ships. Medical planners, based on mission, enemy, and terrain, and troops, time available and civilian considerations (METT-TC), can determine another basis of allocation. Each Air Ambulance (AA) Evacuation Platoon contains an Area Support MEDEVAC Section (ASMS) and three Forward Support MEDEVAC Teams (FSMTs). The ASMS usually consists of six UH-60 Blackhawk MEDEVAC helicopters that provide area support in the division rear area.<sup>36</sup>

These ASMS helicopters also provide emergency movement of medical personnel, equipment, supplies and blood products as needed. This function can, and often is, performed as sling load operations. The three FSMTs provide a means to task organize remaining Blackhawks from the AA Platoon. Most often these assets are allocated in the direct support role in teams of three to provide MEDEVAC from point of injury, Battalion Aid Station, or Ambulance Exchange Points to areas in the rear with higher levels of care. The incorporation of FSTs has modified these evacuation scenarios as noted in the figure below. This unit can also perform combat search and rescue or function as an element of a joint task force as well as provide air crash rescue support to all services.<sup>37</sup> The UH-60A in current configuration provides a maximum lift potential of six litter patients and one ambulatory patient or some combination. Maximum effective range of the standard Blackhawk without auxiliary fuel systems is 315 nautical miles.<sup>38</sup>

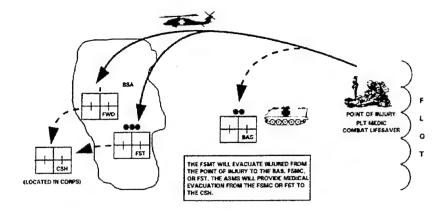


FIGURE 1 - DIVISION LEVEL MEDICAL EVACUATION

The use of Army
helicopters to evacuate
is not performed in a
vacuum. In this era of
joint operations, the
Army component may
very well be the smallest
portion of the total

evacuation system. The Air Force has always been the major player in the movement of patients beyond the combat zone. These patients have routinely been classified as medically stable. The change in conflict type and operations performed has extended distances involved and necessitated some re-thinking of the Air Force involvement. The Air Force may need to evacuate some patients that do not fit in the usual definition of medically stable. Aeromedical Evacuation is the critical link that enables patients to access gradually increasing levels of clinical care. The Air Force evacuation system, like the Army's, is proactive and bases evacuation assets on available facilities in each of the levels of care and anticipated numbers of casualties. 39 The Air Force uses the same levels of care definition to plan for evacuation as those in Joint Pub 4-02 (previously noted). Air Force intratheater evacuation involves movement of patients within the theater of operations from aeromedical staging facilities (mobile and fixed) to the next level of care facilities. This movement is accomplished with dedicated (on call) or scheduled aeromedical aircraft. Although the doctrine is being revised, it is anticipated that patient evacuation from Level 1 to Level 2, from Level 2 to Level 3, or within Medical Treatment Facilities (MTFs) positioned within a named area of operations (AO), will remain the responsibility of individual service components. The revision will continue to employ Army Medical Department (AMEDD) evacuation assets to move the preponderance of injured or sick soldiers, sailors, and airmen in the area of combat operations.<sup>40</sup>

Current evacuation systems handle patient loads without significant shortfalls. Accountability for patients evacuated within theater, as well as between and outside the theaters of the geographic combatant commands and CONUS has been difficult even with small numbers of patients. This situation was painfully evident in the Persian Gulf Conflict and brought significant attention to the medical regulating process. Medical regulating matches patients based on precedence (Urgent, Priority, and Routine) with destination MTFs that have the necessary health care capabilities. This regulating must also account for availability of airlift, open MTF beds and stability and condition of transported patients. The availability of MTF beds

includes not only the physical bed space but also the health care workers necessary to care for the patient and staff the facility. The MTF is responsible for reporting bed status to the Medical Regulating Officer (MRO) by type and availability. 42

When a Joint Task Force (JTF) is formed, the Commander, with the assistance of the JTF surgeon and the Medical Regulating Officer (MRO), coordinates the execution of evacuation operations based on patient medical status and available health care resources. Theater Patient Movement Requirements Centers (TPMRC) are joint organizations located within a theater of operations. They report to the theater surgeon and the JTF surgeon and coordinate theater wide patient regulation and movement by matching MTF capability reports with patient movement requirements and available lift. Existing TPMRCs are located in EUCOM and PACOM. Additional TPMRCs may be established in other geographic areas when the operational need increases.<sup>43</sup>

The actual evacuation operations most often utilize Mobile Aeromedical Staging Facility (MASF) teams or smaller Air Evacuation Liaison Teams (AELTs) to orchestrate the movement of patients within the theater. MASFs are located near runways or airfield taxiways on forward operating bases used by theater airlift aircraft. They notify the TPMRC when an evacuation aircraft has departed, and provide status and/or capability reports to the TPMRC. AELTs have the ability to direct previously dedicated aircraft and obtain on call aircraft based on need. AELTs are often co-located with Level 2 Army facilities and can obtain aircraft with upgraded onboard care capabilities for patients with questionable medical status. In the past, patient regulation began at Level 3. As joint operations become more routine, visibility and regulating of patients is noted by the MRO at a lower and lower level, although current Level 1 and 2 remains service responsibility. 44 For evacuation out of theater, Transportation Command (TRANSCOM) Regulating, Command, and Control Evacuation System (TRAC2ES) processes requests for patient movement at Level 3. As noted above, the tracking of patients in the system during Desert Shield/Storm was a virtual impossibility. For the TRAC2ES to function properly each level of the evacuation system must report the specifics of the patient at each contact.45

The evacuation teams are under multiple constraints as they move patients within and outside of the AO. A major factor is the theater evacuation policy. This policy is established by the Secretary of Defense with input from the theater CINC. The CINC adjusts the policy based on available medical assets and input from the theater surgeon. For deliberate planning purposes, the policy is usually seven days for the combat zone and fifteen days for the theater. Certainly, the patient does not need to be held in theater for the entire duration of the policy, but

can be moved if it is apparent the patient will not be returned to duty within the limits of the policy. The geographic location of the theater impacts greatly on the evacuation policies. In some operations, patients may need to be evacuated directly from point of injury to care outside of the theater or CONUS. Military Operations Other Than War (MOOTW) may not allow the placement of hospitals in the AO and make evacuation a long-distance affair. In an evolving asymmetric warfare scenario, the Special Operations realm dictates very little actual footprint on the ground and makes long distance evacuation and definitive onboard care during transport a necessity versus an option. 47

## ONBOARD CARE

The onboard care of patients in both fixed- and rotary-winged aircraft has evolved rapidly in the civilian community. Physician medical directors trained in Emergency or Trauma Medicine most often supervise the civilian aeromedical transport systems. The actual crewmembers on the transport team are usually two Emergency Medical Technician-Paramedics (EMT-P) or an EMT-P and a registered nurse. The abilities of these health care providers, often augmented by a respiratory therapist, provide "state of the art" onboard care that is difficult to quantify but appears to improve outcome in several published studies. The care of a casualty after pickup depends on the condition of the patient at the time of pickup. The medical personnel onboard the aircraft must be equipped to deal with any circumstance. Their ability to provide care is predicated on the flight time and onboard systems together with their specific skills and abilities. It is understandably necessary for the care providers to maintain a license and verifiable proficiency in a variety of medical skills. <sup>50</sup>

The skills, makeup and continuing education of the onboard care personnel is very consistent and mandated in the civilian community but is not nearly so in the MEDEVAC community in the U.S. Army. In the not so distant past, many of the Army evacuation units worked in concert with the civilian community in the Military Assistance to Safety and Traffic (MAST) program. These programs provided hands on training for the flight medics and crews as they evacuated patients from civilian accidents and effected hospital transfers. With the increased numbers of financially sound civilian evacuation companies/services, the MAST programs have disappeared. The MAST programs provided consistent hands on opportunities for initial training for new flight medics (FMs) and afforded experienced medics the needed patient access to maintain skills. Nearly all units participating in MAST programs had hospital affiliations and the direct oversight of physician regulators. <sup>51</sup>

Medical oversight of the Air Ambulance units in the Army is the responsibility of the parent unit Flight Surgeon, if one is assigned. The credentials of Army Flight Surgeons are usually minimal past a single post-graduate medical year of training and a six-week Flight Surgeon course. The Office of the Surgeon General has attempted to move residency trained, board certified physicians into these positions, although the program is young and has met with some resistance. A FM, a 91B field medic, most often provides the actual onboard care. Most of the practicing flight medics have attended a four-week course at the U.S. Army School of Aviation Medicine (USASAM) that includes Advanced Cardiac Life Support (ACLS) and Basic Trauma Life Support (BTLS). Included in the course curriculum are other basics of primary first aid that are as much a refresher in combat lifesaver skills and aircraft familiarization as onboard care specifics.

The course is undergoing revisions to include directions for material to be mastered prior to attending a 2-3 week resident course at USASAM. This material includes but is not limited to Advanced Cardiac Life Support (ACLS) and Pre-Hospital Trauma Life Support (PHTLS). There is also a strong argument for the inclusion of Pediatric Advanced Life Support (PALS) to prepare for the eventual MOOTW and peace operations that will inevitably employ evacuation crews. The curriculum, in addition to the basic skills that each 91-W medic will have prior to the FM course should give each flight medic sufficient training to handle most any onboard emergency situation and improve care capabilities to a more accepted standard. The actual resident portion of the course will provide flight-testing, aircraft familiarization and practice at the skills not routinely performed. <sup>53</sup>

The fact that this course is not mandatory and is only attended by a small number of reserve component soldiers is disconcerting. It has been difficult to quantify the actual training that reserve crews obtain before performing evacuation operations. As the reserve components assume many of the active component missions, these shortfalls will have an impact on the readiness of evacuation units. Many of the individuals on these crews are first responders in the civilian world and have excellent up to date skills while many others have very limited backgrounds.<sup>54</sup>

Of greater importance is the necessity to mandate uniform Standard Operating Procedures (SOPs) for flight medics. The initial efforts to teach FM skills is wasted effort if the maintenance and expansion of acquired medical skills is not emphasized and monitored. Individual units have a wide range of expectations and each FM must meet standards that are not routinely certified by a well-trained medical professional. Several options have been discussed, but the following table outlines most of the skills that the faculty and staff at

USASAM have agreed are important to maintain as a base for the performance of adequate onboard care:

- 1 24 contact hours of formal didactic coursework:
  - Attendance at Flight Medic Continuing Education (CE) program OR,
  - Attendance at a local MTF or civilian approved EMT refresher course.
- 2 Maintain American Heart Association Basic Life Support (BLS)/CPR with Automatic External Defibrillator certification.
- 48 contact hours additional in-service training (certified by local flight surgeon or AMEDD):
  - EMT-related in-services conducted at local MTF or fire departments.
  - · Attendance at additional formal refresher courses.
  - Recertification in ACLS, PALS, BTLS/PHTLS (16 hours credit each).
  - Distance learning programs developed by AMEDD or USASAM.
- 4 EMT Skills maintenance:
  - Patient assessment and management skills: medical and trauma.
  - Ventilatory and airway management cognitive understanding and skills with O2.
  - Cardiac arrest management (BLS/CPR skills demonstration on actual patients).
  - Hemorrhage control and splinting.
  - · Spinal immobilization.
  - Management of gynecologic bleeding and childbirth and related complications.
  - · Radio communications.
  - Documentation and report writing.

TABLE 1 – PROPOSED FLIGHT MEDIC CE REQUIREMENTS (2-YR INTERVALS) 55

The lack of cohesion in the training and sustainment program for the flight medics is of primary importance. The current standards for the UH-60 air ambulance medics are summarized in the table below, obtained from Training Circular (TC) 1-212. These standards do not provide a significant direction for training and are very broad in scope and intent. The TC

	Task 1 2 3 4	Title Prepare patient for hoist recovery and departure. Relay patient information to medical control. Load, secure, and unload litter and ambulatory patients. Identify and treat adverse effects of altitude on a patient with chest and/or head injuries. Perform a preflight inspection of medical equipment.
1	6	Restrain a patient during flight.
	7	Provide treatment to a patient.

further describes
the unit
commander (an
aviator) as the
individual, in
coordination with
the unit surgeon,
who develops

FIGURE 2 – FLIGHT MEDIC PERFORMANCE STANDARDS<sup>56</sup>

medical standard operating procedures (SOP). There are currently no centralized performance standards to assist with the establishment of local policies.<sup>57</sup>

The 160<sup>th</sup> Special Operations Aviation Regiment (SOAR) has made some inroads in this situation with the establishment of specific standards and training protocols for flight medics. His unit does not routinely have dedicated evacuation assets. However, the nature of the missions this unit is involved with and the lack of dedicated support mandate that SOAR handles medical evacuation as a mission essential task. Many of the flight medics assigned to the unit have been to the medical portion of the 18D Special Forces Medic Course. Refresher training and continuing medical education on a regular basis is mandated by Regimental SOP. These standards are even more important given the nature of the missions undertaken and the lack of initial medical support at the point of injury. The increased range of the SOAR helicopters used as transport, and the resultant extended flight times require long-term monitoring and enroute stabilization until definitive care is reached. The operational tempo of this unit and the rigorous training programs ensure that the flight medics maintain proficiency.<sup>58</sup>

In contrast, the US Air Force maintains a peacetime Air Evacuation System that serves as a good training base for the crews that provide onboard care in the fixed wing aircraft used for medical evacuation. Air Force Instruction 41-301 meticulously outlines the essence of peacetime medical evacuation as training for airmen who must transport casualties during war.<sup>59</sup>

The use of dedicated C-9 (Nightingale) aircraft to move patients has been directed by the Global Patient Movement Requirements Center at Scott Air Force Base in southern Illinois for over 25 years. The usual dedicated crew on these aircraft consists of two flight nurses and three aeromedical technicians without a physician. These crewmembers are mandated by Air Force regulation with specific training and staffing schedules. This team has traditionally moved stable patients, not requiring much in the way of acute onboard care.

The use of a Critical Care Air Transport Team (CCATT) has been added to missions that require monitoring and onboard care beyond the usual scope of "simple" patient movement. The CCATT consists of a critical care physician, a critical care nurse and a cardiopulmonary technician in addition to whatever remnants of the usual onboard care team are available. In a tactical theater the CCATT is assigned to a MASF and is expected to assist during peak casualty flow and manage critical patients. The CCATT can be the dedicated team on an aircraft if required and can stage patients directly from an MTF as required. These onboard care teams have been trained most extensively on the C-9 aircraft, but numerous exercises have been accomplished using all the current Air Force inventory to include the C-130, C-141,

C-5 and the newest lift aircraft, the C-17. Each of the aircraft can be modified to allow the onboard care teams to work in a high tech environment with their usual state-of-the-art capabilities.<sup>61</sup>

#### PATIENT MOVEMENT ITEMS

The care of patients during transit using the best-trained personnel would be minimal without adequate monitoring and intervention equipment. The civilian sector has evolved to the point of including nearly every piece of ground based equipment for use on routine life flight aircraft. Joint Pub 4-022 describes the medical equipment and supplies supporting a patient during movement as Patient Movement Items (PMI). The Joint doctrine identifies the originating MTF as responsible for providing any and all PMI a patient will need during evacuation. This situation may not be as simple as doctrine would indicate. Many smaller MTFs have limited on hand treatment and monitoring PMI. Losing even small amounts of this equipment may hinder further resuscitative care capabilities within the MTF. Communication between the evacuation assets and MTFs is necessary to ensure proper PMI is available for any contingency. To resolve probable difficulties with this part of the system the Air Force has been tasked to create and staff theater PMI centers responsible for in-transit visibility of all PMI.

It is important to note that in the best of circumstances, changing equipment used for treatment and monitoring of any patient is difficult. This situation becomes magnified during transport, particularly with a patient that is marginally stable. As a result of these and other considerations, the Army and Air Force have agreed to maintain some similar PMI and exchange these items during evacuation without removing them from the patient. 63

The exchange of PMI and the necessity for nearly double the expected number of items are only part of the concerns for acquiring and maintaining the newest and most capable equipment that is compatible for both services. The Air Force has been using PMI for many years, most notably in the C-9 Nightingale. They have routinely updated this equipment based on improvements in civilian capabilities and the standard of care available in critical care units.<sup>64</sup>

The Army is many years behind the Air Force in acquiring and utilizing PMI. The PMI in the current medical equipment sets of the MEDEVAC units are outdated, non-uniform, and poorly compatible with equipment in the Air Force inventory. The attempt of compatibility with these items raises multiple issues. The electromagnetic spectrum of PMI is also a problem when transitioning between rotary- and fixed-wing aircraft. To accomplish this task, both services must coordinate testing and certification of PMI for use on aircraft as well as specifics on transfer and care of equipment in tactical situations. The United States Army Aeromedical

Research Laboratory (USAARL) has taken the lead as the agent for testing and certification of onboard PMI. Current doctrine mandates that each piece of PMI must be tested and evaluated for durability and electromagnetic compatibility in each type of aircraft. USAARL has currently certified five pieces of PMI that make up the usual onboard equipment sets to include:

Impact 325/326M Portable Suction Units

Impact 754/754M Ventilator

**BCI International** 3303 Pulse Oximeter

ALARIS Med System III 2863B/2865B Infusion

LIFEPACK 10-59/62 Defibrillators<sup>67</sup>

These monitoring/intervention devices are not new. Smaller, lighter and more capable pieces of equipment are continuously being developed. If the proposed plan for battlefield transfer of PMI is to be effective, the same items must be standard equipment in all services. Initial agreements have been made between the Air Force and Army to allow USAARL to do the

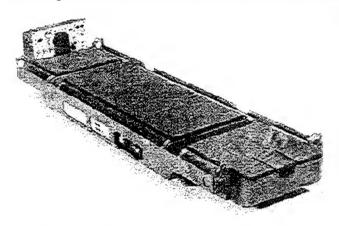


FIGURE 3 - LIFE SUPPORT FOR TRAUMA AND TRANSPORT<sup>68</sup>

testing of all new PMI. USAARL, in combination with all the services and the Army's Directorate of Combat Developments will also need to evaluate newly developed PMI and include them in evacuation care packages as appropriate. <sup>69</sup> The Army has spent considerable time, effort and funds to update PMI by acquiring the Life Support Trauma and Transport (LSTAT). This piece of equipment, while having significant problems, raises exciting

possibilities for coordinated care and is described as a self-contained, mini-intensive care unit in a stretcher.<sup>70</sup> The LSTAT functions well during ground transport, although it has not been given an airworthiness release to be used on all Army or Air Force aircraft. The use of state-of-the-art monitoring and treatment PMI will maintain and improve the impressive lifesaving record the military medical evacuation system has generated.

#### SUMMARY AND RECOMMENDATIONS

Evacuation of casualties from the world's battlefields with draft animals, vehicles and other ground transportation has existed since antiquity. Although ground evacuation has not been discussed in this paper, it will remain an integral segment of the movement of patients on

any battlefields of the future. The history of aeromedical evacuation is short and closely associated with the beginning of manned aviation. The evolution of evacuation of patients using aviation systems has made remarkable strides in parallel with the development of newer, more capable aircraft.

Medical advances in the civilian community have often come as result of casualties sustained in the nation's wars and conflicts. The civilian air evacuation systems had their start as result of military evacuation capabilities developed in WWII, Korea, and Vietnam. Significant and noteworthy progress has been made in the civilian sector in technology and patient care capability. However, the Army MEDEVAC units closely resemble the Vietnam-era units in their capabilities to provide onboard/enroute medical care. The Army is currently re-examining the capabilities and criteria for mission success of these units. The AMEDD's Office of the Surgeon General appears to have made decisions to upgrade the capabilities of the system to create air medical transport assets as opposed to simple transport tools to clear the battlefield. The ability of the Air Force to provide care, however, has evolved steadily as they provide evacuation utilizing the Nightingale in peacetime. This evacuation service provides training quite similar to the expected service needed in wartime.

The changes in doctrine for the techniques employed by the evacuation system have in part been mandated by the different missions that the U.S. military has taken as routine. Military Operations Other than War (MOOTW), unlike conventional warfare, will most probably result in decreased numbers of casualties. However, the lack of definitive care assets that would normally be deployed in a developed theater will necessitate substantial evacuation distances. Ongoing changes in doctrine have not affected the impression that the Army will continue to be responsible for evacuation from point of injury to Level III care. Simple onboard monitoring, without specific care capabilities, will not allow marginally stable patients to survive the long evacuation legs necessary to reach definitive care.<sup>73</sup>

The emphasis on medical care in the Uniformed Services has extended to all military arenas. The public is willing to accept deaths as an unfortunate cost of maintaining their freedoms. However, the tolerance for medical care that is perceived as less than the recognized standard is low. This attitude is forcing the standards of care at all levels of care and during transport to closely approximate the civilian counterpart. The onboard care in the Army evacuation system will need to improve to reach a level commensurate with civilian care. The personnel caring for patients in Army aircraft are beginning to change by necessity and mandate. The 91W program is a new Army-wide effort to bring the basic medic to new levels and capabilities. The knowledge base of each medic will include upgraded trauma skills and the

EMT-basic (or higher) that civilian first responders have made standard. These skills and more will be required as better and more technologically advanced equipment is moved into the system. Each medic that performs duties involving flight, to include reserve component medics, must attend the Flight Medic Course at Ft. Rucker and maintain his knowledge base through adequate ongoing training. Forthcoming changes in the didactic and resident portions of the course will better prepare FMs to handle any onboard emergency scenario.

These continuing medical education standards should improve the quality of onboard care but will be worthless without the cooperation, oversight and enforcement of the aviation unit commander. Of equal importance is the need for each evacuation unit to have the medical oversight of a flight surgeon or other medical professional with intimate knowledge of the mission and standards of MEDEVAC. He must be responsible for training and performance standards. The realization that MEDEVAC, as opposed to transport of casualties, can only be accomplished with competent medical care in the rear of the aircraft is well accepted by the AMEDD. The emphasis on training and continuing education of all health care providers is a basic tenet of the Army Surgeon General.<sup>75</sup>

The care providers in the MEDEVAC system will not be able to adequately assist patients without state-of- the- art PMI. Initial agreements have been made between the Air Force and Army to allow USAARL to test and evaluate new PMI and to include them in evacuation care packages as appropriate. This spirit of cooperation must be extended to the purchase of newer, more capable equipment. The LSTAT is a useful piece of PMI but is expensive, bulky, and significantly limits the number of patients that can be loaded in existing airframes. Technology is making equipment smaller, lighter and more capable. These characteristics are all desirable assets in the aviation realm and should make the LSTAT and other current PMI relics of the system. The ability of MEDEVAC teams to transmit real time data to the facility accepting the patient is of major concern. Advances in telemedicine and broadcast technology allow civilian systems to make receiving hospitals aware of the actual patient status before aircraft arrive. In the military realm, the improvement of telemedicine and real time monitoring system should allow greater visibility of status and positively affect enroute patient regulation. The interest is a specific patient of the system of the actual patient regulation.

Department of Defense should dedicate funds to continue the purchase of upgraded PMI and transmission equipment to ensure patients have the best opportunity for survival. USAARL should continue to be the lead agent for testing and evaluation (T and E) of new PMI. T and E should be accomplished before the acquisition system purchases any new piece of PMI.

The Army Transformation initiative has forced technology to develop lighter, more lethal and more rapidly deployable systems and units. The AMEDD has also been profoundly

affected by this direction. The requirement for a decreased logistical footprint will mean that there are fewer medical assets in the forward combat areas. All these factors will increase the importance of rapidly clearing the battlefield and providing the appropriate enroute care to reduce morbidity and mortality in soldiers. The movement of FSTs forward in the combat zone will further tax an already compromised evacuation system. The FST will have no holding capability and will be rapidly overcome by sheer numbers in any mass casualty situation. This confirms the need for medically capable crews and technologically advanced platforms.<sup>77</sup>

The Army is counting on the UH-60 Blackhawk to be that aircraft for at least the next 15 years. The AMEDD has pushed for the development of the UH-60Q model with enhanced onboard care capabilities. However, the environment in the cabin area on the Blackhawk is still very noisy, cramped and has significant vibration problems that have not been fully evaluated. The OBOGS is not sufficient to power many of the newer ventilators. The flight characteristics of the Q model Blackhawk are very similar to older versions. Range and speed are unchanged, as is the survivability of the aircraft. The newer model does have an advanced avionics package that allows a greater all-weather capability. This improved package also includes compatibility with the digital ground units it must support, at least in theory. As of this writing, the newest UH-60Q aircraft do not have airworthiness releases and the only types of these aircraft flying are demonstration platforms in the National Guard. These noteworthy deficiencies combined with the uncertainty of the ability of the Air Force to provide dedicated aircraft far forward brings the adequacy of the UH-60Q into question. The second aircraft far forward brings the adequacy of the UH-60Q into question.

The Army should speed fielding of the UH-60Q model while beginning the purchase of a newer transport rotorcraft/tiltrotor. The purchase of 64 of these aircraft would result in a decreased need for 185 UH-60Q Blackhawks in designated MEDEVAC units. <sup>79</sup> Increased cost of the newer aircraft would be offset by savings in the purchase of UH-60Q models and the ability to place non-MEDEVAC Blackhawks in the rest of the Army force. Purchases of any new MEDEVAC platform should be staffed through USASAM, USAARL, and the Special Operations community.

At this point, the Air Force will fly forward missions to "secure airfields" with birds of opportunity. This translates to a system based on aircraft schedules, not casualty flow requirements. In the Persian Gulf and other conflicts to this point, the system has worked but it has come nowhere close to being taxed outside of these limits as would happen with large numbers of casualties. This threat stresses the Army's need for a dedicated "future transport rotorcraft" of some variety. This dedicated, on call transport would cover all MEDEVAC contingencies and types of operations. This aircraft must have the size and onboard

capabilities to accept improved PMI and have intrinsic assets to provide treatment and sustain casualties for prolonged flight times. It must also have threat avoidance capabilities and be able to identify pickup points, and visually acquire patients at night and in bad weather. This same aircraft must have long-range ability and the speed to reach definitive hospital care, farther and farther from the actual fight.<sup>80</sup>

Several points have been raised about direction for improving casualty care on the battlefield. These directions are not new. Attempts have been made in the past to bring care on line with the military's civilian counterparts. Recent events have mandated greater scrutiny and the necessity to transport patients with enhanced care and speed. There is little question that some of the comfort a soldier, sailor, airman, or marine takes into combat is the knowledge that the might of the military's medical system is available. Based on what we know about advancing medical capabilities, the sister services can and must work together to provide an aeromedical evacuation system that will not only clear the battlefield but provide onboard care second to none.

The Army is changing and the ability of the United States and our allies and enemies to wage war is more complex. The AMEDD must adapt and implement new programs to successfully meet the challenges of patient evacuation. This paper has explored the historical background, examined the varied aspects of evacuation and suggested changes that will significantly improve the Army's evacuation system. By changing the training programs, upgrading and standardizing PMI, adding qualified medical personnel, and improving the capabilities of MEDEVAC platforms the AMEDD will be positioned to provide world-class support to the Army's most valuable asset – its people.

WORD COUNT = 8,071

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